EXPLORING THE SYNERGIES OF GAMMA ALUMINA AND TUTTON SALT HYDRATES IN THERMOCHEMICAL ENERGY STORAGE

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In the International Energy Agency's recent evaluation of progress toward the Net Zero Emissions by 2050 Scenario, only 3 of over 50 components of the energy system were considered fully "on track" [1]. In the energy sector, all components except for solar PV are "not on track" or are labeled as "more efforts needed". In order to ensure an optimal use of renewable energy, however, it is necessary to not only achieve better mastery of the renewables themselves but also to store their energy of fluctuating availability and overcome the space-time mismatch of energy supply and demand. Furthermore, in the buildings category, lighting was the only "on track" component, whereas heating, space cooling, and heat pumps require more efforts. At the crossroads of energy storage and the heating and cooling sector lies thermal energy storage, and as chemists, we have chosen to focus on thermochemical energy storage to harness the energy of hydration of salts for energy storage.

Having consulted our VIENNA TCES database, we found numerous sulfate hydrates, such as the Tutton salt picromerite, $K_2Mg(SO_4)_2 \cdot 6H_2O$ and focused our efforts on newly synthesized mixed Tutton salts $M_2M'_{1-x}M''_x(XO_4)_2 \cdot 6H_2O$. Desiring to obtain a higher thermal conductivity than that of the pure salt, we considered numerous support materials. Rather than using conventional alpha alumina, we focused our attention on gamma alumina, as its high thermal conductivity is promising, and it has been used previously as a support for salt chloride hydrates [2]. Herein, we present progress toward the synthesis and characterization of gamma alumina – Tutton salt hydrate composites as thermochemical energy storage materials.

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[1] IEA (2023), *Tracking Clean Energy Progress 2023*, IEA, Paris https://www.iea.org/reports/tracking-clean-energy-progress-2023, License: CC BY 4.0

[2] M. Ocvirk, A. Ristić, N.Z. Logar (2021), Synthesis of Mesoporous gamma-Alumina Support for Water Composite Sorbents for Low Temperature Sorption Heat Storage, Energies, 14 (22).